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Treatment Manual

Nonchemical Treatments

Heat • Forced Hot Air

Contents

Forced Hot Air Treatment for Fruit

Pre-Treatment Procedures

The target pests of these treatments are fruit flies. An APHIS Inspector must monitor all treatments done for quarantine purposes. To avoid condensation on the fruit surface and improve fruit quality, maintain the dew point temperature of the chamber 2 °C cooler than the temperature of the fruit surface. However, for regulatory purposes, APHIS shall base the validity of treatment solely upon the center pulp temperature of the fruit. Control of blower speed and relative humidity in the chamber are the sole responsibility of the operator.

NOTICE

Do not conduct any preconditioning treatments (such as degreening) in the FHA chamber.

1 Forced hot air (FHA) is also referred to as high-temperature forced air (HTFA).

Sizing the Fruit

Before treatment, sort fruit by size. For some fruit, a size and weight limit has been established. After sizing, fruit that exceed the permitted size classes are not eligible for shipment. There is no minimum size requirement. The various sizes of fruit can be treated either *separately or together at the same time*, in their own respective trays or bins. For best results, however, only fruit similar in size and variety during the same run.

Placement of Permanent Temperature Sensors (Probes)

Monitor the precise placement of sensors (at least one per column). Insert the sensors into the *center* of the *largest* fruits of the lot, at the *top* of the load of fruit located closest to air that exits the chamber. (Research has shown that the fruit in this location require the longest time to heat.) Do not to pinch the sensor cables.

In a FHA chamber that has *bottom air delivery*, place all sensors in large fruit in the *top layer* of trays or bins.

In a FHA chamber that has *top air delivery*, place all sensors in large fruits at the *bottom layer* of trays or bins.

In a FHA chamber that has *both bottom and top air delivery*, *side delivery*, or that has air delivery with a *reversible direction of flow*, place all sensors in large fruit in the *middle layers* of trays or bins.

Loading the fruit into the FHA chamber:

Under supervision of the APHIS Inspector, load bins or trays containing fruit directly over the delivery air source. Cover space around the edges of the air supply ducts. The intention is to force the heated air through the slatted sides or bottoms of the bins or trays, not around them.

There is no minimum or maximum fruit pulp temperature required prior to beginning the treatment.

Procedures for Performing the FHA Treatment

Monitoring the temperature:

After the fruit has been loaded into the chamber, close the door and turn of the FHA-generating equipment. The temperature recorder will then begin making numerical recordings of temperatures from each sensor at least once every five minutes, or make continuous pen-line recordings, color-coded for each sensor, on a graph paper readable in

tenths of a degree (Farenheit or Celsius). After the *warm-up period* [see below], increase the frequency of temperature recordings to once every two minutes.

Increase the fruit pulp temperature (on all sensors) to the *target temperature* stated in the treatment schedule. This temperature increase must be done gradually and during a *warm-up period*. If the fruit are cool initially, they will require a longer approach time to achieve the target temperature. The temperature of the delivery air should be slightly hotter than the target temperature. When all the fruit with sensors have reached their target temperature, and their minimum warm up time has been completed, the fruit center temperature (on all sensors) must then remain at or above treatment temperature for the amount of *dwell time* specified in the schedule. The APHIS Inspector must review and approve the temperature records (by initialing them) when the entire treatment (warm-up period + dwell time) has been completed.

NOTICE

For treatments with no dwell time specified, all permanent pulp temperature sensors must simultaneously register the treatment temperature, or higher, for two consecutive readings.

Control of air delivery temperature and blower speed:

The delivery air must be warmer than the target fruit pulp temperature, but this matter is left to the discretion of the operator. APHIS will not require any particular temperature set point, because the treatment is based upon pulp temperature, not air delivery temperature. The operator is also given the flexibility to change the temperature of the delivery air at various times during treatment. Based upon operator experience, the delivery air temperature and/or blower speed can be varied according to the height (length) of the columns of fruit in the FHA chamber.

NOTICE

The APHIS Inspector monitoring the treatment may void (negate) a FHA treatment for failure of the operator to follow any treatment requirements.

Post-Treatment Procedures and Safeguards

Post-Treatment requirements

After treatment, immediately move the bins or trays to a secured holding room or area (quarantine zone). After a 30-minute waiting period, the fruit can be cooled to enhance their quality (optional), and placed into commercial cartons. Other procedures, such as degreening and application of fungicides, are done at the option of the operator of the facility.

Stamp each carton "APHIS-USDA TREATED WITH FORCED HOT AIR," together with the APHIS stamp number assigned to the facility. Do not be preprinted or prestamped cartons with this information. Official rubber stamps will be controlled by the APHIS Inspector.

Exporter Compliance with Prescribed Safeguarding and Safety Measures

The exporter will be responsible for:

- Designating an operator to be present throughout the entire treatment period (warm-up time + dwell time), who is trained and thoroughly familiar with treatment procedures and operation of the FHA chamber
- Maintaining the FHA chamber and packing house in a safe and sanitary condition at all times; this includes:
  - Providing industrial first-aid kits and approved safety equipment at the facility and training in their use
  - Ensuring local authorities and hospitals are aware of treatment activities, and are prepared to handle emergencies such as burns
- Performing each FHA treatment in a manner that conforms with APHIS requirements and sound safety procedures
- Providing adequate safeguards to prevent treated fruit from becoming exposed to the risk of reinfestation

Equipment and Materials Provided by the Exporter

Forced Hot Air Chamber

Heated air is delivered by means of high-speed blowers or fans at a recommended air speed of two meters per second or higher. The air is forced to pass vertically or horizontally through the load of fruit being treated. It then passes out of the chamber through a heating system, and is returned to the chamber at the opposite end. Construct the chamber to accommodate the placement of several portable sensors during the yearly performance test. For this purpose, temporary access through an opening or openings in the chamber walls is required.

Trays or Bins

To facilitate movement of heated, moist air through the column(s) of fruit, treat fruit in containers with solid sides perpendicular to the direction of air flow, and vented or open sides in the direction of air flow.

Permanent Temperature Sensors

Permanent temperature sensors can be high-performance RTD, thermistor, or thermocouple sensors (probes), installed at the ends of insulated wire cables long enough that all areas of the load can be reached. Fruit pulp sensors must be at least two inches in length. The operator of the facility must maintain a supply of extra sensors to use as replacements.

The minimum number of sensors required shall be in proportion to the size of the load of fruit. The number of permanent sensors should never be less than ten (10). However, each stack (column) of fruit must contain at least one fruit pulp sensor. For Example: A chamber with 5 stacks must have at least 10 sensors. A chamber with 20 stacks must have at least 20 sensors. It is recommended, however, that several extra sensors be installed.

In addition, it is recommended that additional sensors be installed to monitor supply air, return air, fruit surface temperature, and relative humidity. (For required placement of pulp sensors, refer to the earlier discussion.) Number the sensors corresponding to a particular printout or pen-line shown on the recorder. Accuracy must be to within plus or minus 0.5°F (0.3°C) of the true temperature.

Automatic Temperature Recorder

An automatic temperature recorder is a computerized device that may be either a data logger or a continuous strip chart pen recorder. The combined accuracy of the entire temperature recording system must be to within plus or minus 0.5°F (0.3°C) of the true temperature, and the recording must be readable in whole degrees and tenths. Keep this sensitive equipment inside an air-conditioned control room. An electrical surge protector is also recommended, to provide protection from voltage irregularities (power surges). For data loggers, one print shall be required for each sensor, at least once every five minutes during warm-up, and every two minutes during dwell time. The recorded model must be approved in advance by APHIS. Circular graph temperature recorders are not acceptable.

Portable Temperature Sensors

Portable temperature sensors will be used by the APHIS Inspector during the yearly performance test. For every two permanent pulp sensors installed, at least one portable sensor must be available when needed for performance testing. As an option, additional permanent sensors can be used, if the automatic temperature recorder is capable of handling the additional capacity. In the case of permanent sensor malfunction, portable sensors can also serve as emergency back-ups.

For example: For a FHA chamber using 20 permanent pulp sensors, at least 10 portable sensors (or 10 additional permanent sensors) are required for the purpose of conducting the performance test for certification.

Portable Temperature Monitor

A portable temperature monitor will be used by the APHIS Inspector during the yearly official performance test. It must be capable of reading in whole degrees and tenths. This instrument can be either a simple, hand-held thermistor devise that can be quickly connected to individual portable sensors in sequence, or it may be a more complex device that is capable of monitoring several sensors at once.

In the absence of a portable temperature monitor, the chamber's permanent temperature recorder can be used during an official performance test, if it is capable of monitoring the minimum number of additional sensors required for the test (in addition to the normal number of permanent sensors).

If available, the APHIS Inspector can use cordless sensors during the yearly official performance test, if available. After the treatment is completed, download readings from these sensors onto a computer.

Due to expense, the exporter shall not be required to purchase cordless sensors.

Certified Thermometer

Keep a certified glass-mercury, water-immersible stick thermometer, readable in tenths of a degree, on the premises at all times. This thermometer must be certified by the factory to be accurate to within plus or minus 0.5°F (0.3°C) of the true temperature, and must cover the range between 104°F and 122°F (40°C to 50°C). Use this thermometer as the standard against which all sensors are calibrated. It must be recalibrated by the manufacturer, or by an independent testing laboratory, at least once every five years.

Portable Calibrator

A portable calibrator is usually a small, swirling heated water bath, which provides a constant water temperature while calibrating the sensors.

Fruit Sizing Equipment

Because fruit sizing is required *before treatment,* place the fruit sizing equipment in an area of the plant that is outside the quarantine zone.

Air Curtain and/or Double Doors

Air curtain-generating apparatus (if used) must be located on the wall or ceiling at the entrance to the quarantine zone, and must blow air in an outward direction from the quarantine zone whenever the door is opened. A second option is to install a double-door system (with a short walkway between the doors) at the entrance. Only one of the two doors may be open at a time.

Quarantine Zone

Immediately after treatment, bring treated fruit to an insect-free encloser (usually a screened room). Place packing line, palletizing, and banding equipment within this zone. A cooling system is optional. Fruit for markets other than the United States are not allowed to be present in the quarantine zone. Detection of live insects in the quarantine zone can be used as grounds for refusal to allow shipment of treated fruit. Untreated fruit is not allowed in this zone at any time.

Cooling Equipment for Treated Fruit

Thirty minutes after completing FHA treatment, the fruit can be cooled. Forced air cooling can be done inside or outside the FHA chamber. Air temperature is optional. The fruit can also be brought to a refrigerated room within the quarantine zone. Cooling the fruit is not mandatory, but can be done to preserve fruit quality. It is not an integral part of the quarantine treatment.

Dry Heat Treatment Facilities for Niger (*Guizotia abyssinica*)

Introduction

Niger is grown as a marginal crop mainly in India, Ethiopia and Burma. Its black seeds are imported into the United States for bird feed. Since niger is frequently contaminated with Federal Noxious Weed seeds, the seeds from any foreign place, at or before the time of arrival at the port of first arrival, are required to be heat treated in accordance with the applicable schedule of the PPQ's Treatment Manual.

Location of Treatment Facilities in the US

Construct the proposed niger treatment facility near the port environs; not exceeding 10 miles from the port.

Checklist of USDA-APHIS Minimum Requirements for Dry Heat Treatment Facilities for Niger seed Treatment

Minimum Requirements for Dry Heat Treatment

- Accuracy of the total temperature recording system must be within plus or minus 0.5ºF. (0.3ºC) of actual temperatures as recorded by a certified calibrated thermometer
- Action plan is be established to address any pests that may be associated with the storage, treatment, or shipment of niger seed
- All the valves and controls that affect heat flow to the treatment system are secured to avoid manipulation by unauthorized personnel during the treatment process
- Audible alarm or highly visible light is installed on burners or other equipment to indicate system failure and/or when not operating properly
- Gear systems used to control the niger seed conveyor (if applicable) are capable of being adjusted as necessary to meet treatment requirements
- Heating controls are automatic and run continuously throughout the treatment process. Manual adjustments are allowed, if necessary.
- Minimum of two temperature probes are situated in the heat-treating equipment in such a way as to determine that all niger seed being treated reaches the target temperature
- Proper sanitation measures are implemented to ensure there are no potential breeding grounds for pests on the premises, and therefore, little risk of reinfestation or cross-contamination
- Seed processing equipment has the capability to divert for retreatment any nontreated or treated seeds that do not meet treatment standards
- Speed indicator is present for continuous flow systems.
- Temperature readings are recorded on the chart at time intervals not exceeding 4 minutes between each reading
- Temperature recording chart is showing changes in temperature in increments of not less than 0.1 inch for each degree Fahrenheit (ºF) or 5 mm for each degree Celsius (ºC)
- Treated seeds are stored in a location separate from nontreated seeds-the treated and nontreated seeds must be handled in a manner to prevent cross-contamination

Requirements for a valid treatment

Facility Requirements

- Facility operators or managers must record the following information on each treatment chart:
  - Date
  - Lot number
  - Operator signature
- Minimum number of temperature recording elements is two fixed temperature probes-accurate time/temperature records will also be maintained for any additional probes
- Treatment must be in a niger seed facility maintaining current valid approval in good operating order so as to be capable of providing an acceptable treatment

Treatment Requirements

The niger seed heat treatment schedule will be for at least 15 minutes at 120°C (248°F) and the following procedures will be used by operators to determine if treatment standards are met.

- Examine treatment records for completion of treatment
- If any temperature reading falls below 120°C (248°F), nullify the treatment for that specific lot of seed and retreat the seed
- If, for any reason records indicate that the niger seed was not held at the target temperature for the required time, retreat the niger seed and correct the reason for the faulty treatment before continuing any niger seed treatment
- Verify that the niger seed was kept at the target temperature for the required time

Documentation Requirements

- Maintain a logbook of all niger seed treatments
- Maintain records of equipment breakdowns and repairs and changes or modifications to the treatment process

Sanitation and Pest Control

The Plant and Warehouse premises

The premises must have a cleaning and control program. The facility manager will ensure that there are no potential breeding grounds for pests in the premises, and therefore little risk of reinfestation or cross-contamination.

Containers and Packaging

The facility manager will ensure that packaging, whether used or new, is checked and cleaned for pests so that the packages are not a source of pests and contamination

Waste Disposal

To minimize contamination risk and eliminate pest breeding sites, the facility manager will implement a regular waste program for waste and for nonconforming or infested produce.

Post Treatment Requirements

- After treatment and cooling, immediately place the niger seed in new bags-treat or dispose the old bags in a manner that will eliminate regulated pests.
- PPQ will monitor (by sampling the treated seeds periodically) for actionable contaminants
  - Some time in the middles of the bagging process, sample every 25th lot after treatment
  - Perform random inspections and viability tests as needed by PPQ at the Port of Entry

Label each sample with the following information:

- Bill of lading number
- Container and lot number
- Date the sample was taken
- Date the seeds were treated
- Origin of seed
- Vessel name and nationality

Send laboratory results with the above information to USDA-APHIS-PPQ-CPHST, Treatment Support & Certification, 1017 Main Campus Drive, Suite 2500, Raleigh, NC 27606.